A stowable table for a vehicle

The present invention relates to a stowable table for a vehicle, particularly a passenger aircraft.

It is commonplace in the art to provide each passenger on a vehicle such, for example, as a passenger aircraft with a stowable table, particularly, but not exclusively, for the purpose of supporting receptacles for food or drink which the passenger may consume during the course of a journey. Generally, such a stowable table should provide a table surface which is sufficiently large to accommodate the food and drink receptacles with which the passenger will be provided during the journey, and should be stowable to provide the passenger with more room when the table is not required and, in the case of an aircraft, for take-off and landing. Furthermore, such a table should also be sufficiently large to provide a convenient working surface, especially for business-class passengers.

In a conventional passenger aircraft cabin arrangement, a plurality of seats are arranged in rows, one row behind another, with the seats in the different rows being aligned with one another, such that, except in the front row, each seat has another seat directly in front of it. Where the rows are sufficiently closely spaced (i.e. have a relatively small pitch) a table associated with a seat may be conveniently mounted on the back of a seat in front. Such a table may be stowed by folding it flat against the back of the seat in front, and may be deployed when required by folding it down to a substantially horizontal orientation, over the knees of the passenger using the seat. Stowable tables of this kind are, however, only practical when the pitch between adjacent rows of seats is sufficiently small.

Rows of seats in business-class and first-class sections of the passenger aircraft are typically set at greater pitch than the rows in an economy class cabin, and typically comprise more elaborate seats including more substantial arm-rests on each side of the seat. For such seats, it has become commonplace to provide a stowable table in one of the arm-rests, and numerous different mechanisms are known in the art for deploying a table from an arm-rest to a substantially horizontal position in which it extends over the knees of a passenger using the seat, so that it is conveniently positioned for the passenger to work on the table, or to support crockery, glassware, trays, and the like for meals.

Recently, more innovative seat designs have been developed especially for use in the business and first-class cabins of passenger aircrafts. Whilst such seats are still generally arranged in rows which extend across the width of a passenger aircraft cabin, they are quite often arranged at an angle to the front-to-back axis of the cabin, such that

each seat does not have another seat directly in front. Furthermore, as before, the pitch between adjacent rows of such seats is typically too great to enable a seat in front to provide a suitable support for a table to be used by a passenger using a seat behind. Examples of such seating systems are disclosed in WO 96/18537 A1 and WO 03/013903 A1, the contents of which are incorporated herein by reference. A common feature of such designs is the provision of a shaped screen disposed on at least one side of each seat to shield each seat at least partially from its neighbouring seat(s), and to give each passenger a well-defined, personal cabin space.

Whilst there has therefore been significant development in the field of seat design, there has been relatively little progress in the design of stowable tables for seats.

Clearly, the size and style of a table to be stowed in an arm rest is dictated to a large extent by the size of the arm rest. As a result, such tables tend to be fairly small, and are typically fairly insubstantial in that in order to be stowed within the arm rest they must comprise a plurality of folding parts, and this tends to reduce the overall stability and rigidity of the table. Furthermore such tables must usually be supported by the other arm rest to provide some degree of stability.

A number of recent seat designs for business class and/or first class passengers comprise a "buddy seat" associated with each main seat, which "buddy seat" may be used temporarily in-flight by another passenger who is visiting the passenger using the main seat. In some designs, the "buddy seat" may also be used as a foot-stool. Clearly, it would be desirable for airlines to provide such a visiting passenger with the possibility of dining with the passenger he or she is visiting at the main seat. However, for this, a table which deploys only over the knees of the passenger using the main seat would be undesirable, and a table of greater size would be needed to provide sufficient room for two meals.

WO 96/18537 A1 discloses a seat unit for a first-class section of a passenger aircraft, which seat unit comprises a primary seat and an opposing secondary "buddy seat". A stowable table is accommodated within a table storage portion of a wall positioned adjacent the seat unit, which table can be selectively deployed between the primary and secondary seats *via* an access slot in the wall. In the deployed position the table is cantilevered from the table storage portion. However the overall size of the table is limited by the space available within the table storage portion, and in the deployed position the cantilever between the table and the wall is relatively unstable, limiting the load that can be supported by the table.

An object of the present invention is to provide a novel stowable table for a vehicle, particularly a passenger aircraft.

Another object of the present invention is to provide a stowable table for a vehicle which, when deployed, is stable and capable of bearing significant loads.

Yet another object of the present invention is to provide a stowable table for a vehicle, particularly and aircraft, which is larger than conventional aircraft meal tables, and in particular is sufficiently large to accommodate easily the meals of two passengers at the same time.

According to one aspect of the present invention therefore there is provided a stowable table for a vehicle, particularly an aircraft, said stowable table comprising:

mounting means adapted to be fixedly secured to a supporting structure;

table-top means comprising a table-top member;

connecting means for connecting said table-top means to said mounting means, said connecting means comprising guiding means which are adapted to allow the table-top means to slide substantially vertically with respect to the mounting means when fitted between a first lower stowed position and second upper deployed position, and to allow said table-top means to rotate about a substantially horizontal axis between a stowed upright orientation when in the first stowed position, and a substantially horizontal deployed orientation when in the deployed position; and

cantilevering means for cantilevering the table-top means from the mounting means in the upper deployed position such that said table-top means are capable of bearing loads in the deployed orientation, said cantilevering means comprising engaging means on the table-top means, and abutment means on the mounting means; said engaging means and abutment means being configured and arranged to engage one another when the table-top means are rotated to the deployed orientation and the deployed position; and said guiding means being further adapted to locate the table-top means in the upper position, such that said engaging means and abutment means engage one another stably when the table-top means are rotated to the deployed orientation.

Thus, in accordance with the present invention, the stowable table may comprise dedicated abutment and engaging means for cantilevering the table-top means from the mounting means in the deployed position and deployed orientation, and the guiding means may serve to locate the table-top means stably in the upper position, so as to allow the

abutment means and engaging means to engage one another stably and effectively for supporting, by means of a cantilever, the weight of the table-top means.

Said engaging means may comprise a plurality of formations on the table-top means, which formations may be adapted to rotate with the table-top means.

Said abutment means may comprise a plurality of corresponding abutment plates.

In some embodiments, said formations and abutment plates may be made from suitable non-resilient, hard, load-bearing materials such as steel.

Said table-top member and said formations may be arranged such that when said table-top means are disposed in the deployed orientation, said table-top member projects in a forwards direction from said horizontal axis, and said formations project generally forwardly from said axis and in a generally opposite rearwards direction from said axis; said corresponding abutment means being disposed generally in front of and behind said axis, such that in the deployed position and orientation, said mounting means react on the table-top means through said abutment means at spaced positions at either said of the axis for effectively cantilevering the table-top means.

Said table-top means may comprise a rotatable shaft, said table-top member being connected to the shaft, and said shaft being disposed on said substantially horizontal axis; said formations may be fixedly mounted on the shaft. Said shaft may comprise a ball-spline.

The stowable table in accordance with the invention may be suitable for mounting in a recess formed in an hollow side-wall forming part of a seat housing around a seat. Typically such a side-wall comprises internal supporting structure fixed to the infra-structure of the vehicle (e.g. through seat tracks on an aircraft) and is clad in suitable panelling. In accordance with the present invention, said panelling may have a shaped opening formed therein to provide access to the interior of the side–wall, and the mounting means may be fixedly secured to said supporting structure. Advantageously, the stowable table in accordance with the present invention, in the stowed position and orientation, may occupy a small footprint area, allowing the table to be accommodated within relatively thin side walls. By providing engaging formations which project forwardly and rearwardly of the horizontal axis when the table-top means are oriented in the deployed orientation, maximum use of the available width of the side wall may be obtained, such that the mounting means react on the table-top means through the abutment means at locations which are spaced apart on either side of the axis.

In the stowed position, the table-top member may occupy substantially the whole of the opening formed in the side wall, with a small tolerance, so as to close the opening. Said table-top member may have a lower surface which is arranged to face outwardly in the stowed position, which surface may be disposed flush with the surface of the panelling of the side wall in the stowed position.

Said guiding means may comprise track means on the mounting means, and corresponding track-following means on the table-top means, which track following means are constrained to slide along the track means for guiding the table-top means between the stowed and deployed positions. Said guiding means may thus provide controlled translational movement of the table-top means between the stowed and deployed positions.

Said track means may comprise two spaced, upright tracks, and said track following means may comprise two corresponding rollers on the table-top means. Each of said rollers may be arranged to engage in a corresponding one of the upright tracks. It is unnecessary for the tracks to be vertical in the fitted position, but they should extend vertically such that as the table-top means move from the stowed position to the deployed position they move *inter alia* in a vertical direction.

Said track following means may be positioned on the horizontal axis.

Accordingly, said rollers may define the axis of rotation of the table-top means.

Said guide means may further comprise means for controlling rotation of the table-top means according to the position of the table-top means between the lower stowed position and the upper deployed position. Thus, as the table-top means are moved between the lower stowed position and the upper deployed position, the orientation of the table-top means is controlled automatically.

Said rotation controlling means may comprise shaped cam means on the mounting means and corresponding cam-following means on the table-top means; wherein said cam means and said cam-following means are configured and positioned relative to the track means and track following means to position the table-top means in the stowed orientation when in the stowed position, and in the deployed orientation when the in the deployed position.

Said cam means may be configured to cause progressively greater rotation of the table-top means about said horizontal axis from the stowed orientation to the deployed orientation as the table-top means move from the lower stowed position to the upper deployed position.

It is unnecessary for the table-top means to be rotated by the rotation controlling means at a fixed or constant rate as the table-top means move translationally from the lower stowed position to the upper deployed position. The rotation controlling means may be adapted to rotate the table-top means to any desired orientation at each point between the upper and lower positions. For instance, in some installations, it may be desirable for the table-top means to move initially from the stowed position towards the deployed position without any significant rotation in order to ensure that the table-top member is moved clear of any adjacent, low-lying objects such, for example, as a foot-stool or the like. In some embodiments, the rotation of the table-top means from the stowed orientation to the deployed orientation may take place substantially wholly in an upper section of movement of the table-top means from the stowed position to the deployed position. However, in order to provide effective location of the table-top means in the upper position, it is desirable for at least the final rotational movement of the table-top means into the fully deployed orientation to take place progressively over a sufficient length of the translational movement.

Said track following means may be positioned on the horizontal axis, and said cam following means may be offset from said axis; said track means and cam means may extend generally upwardly from respective lower ends to respective upper ends when fitted to said supporting structure, and said cam means may diverge from the track means as they extend from their lower end to their upper end to cause progressively greater rotation of the cam following means about said axis so as to cause the table-top to rotate from the stowed orientation to the deployed orientation as it moves from the stowed position to the deployed position.

In some embodiments, said cam means may be inclined upwardly and rearwardly with respect of the track means.

Said connecting means may further comprise means for counter-balancing the weight of the table-top means as they move between the stowed and deployed positions. A number of different devices for counter-balancing the weight of the table-top means will be apparent to those skilled in the art, but in some embodiments a constant force spring mechanism connected between the table-top means and the mounting means may be employed.

Said guiding means may further comprise two spaced racks on the mounting means, which racks extend substantially vertically when fitted to the supporting structure,

and two corresponding, freely-rotatable pinions mounted on the table-top means on said horizontal axis in engagement with the racks, thereby to obtain smooth movement of the table-top means between the upper and lower positions. In particular, the interengagment of the racks and pinions as the table-top means move between the upper and lower positions may prevent "crabbing" of the table-top means.

In another aspect of the present invention, said table-top means may comprise means for connecting said table-top member to said guiding means and providing lateral reciprocal movement of said table-top member relative to said mounting means when said table-top means are disposed in the deployed position and orientation, said table-top connecting means comprising a ball spline connected to the guiding means and arranged to allow said table-top member to slide in a direction substantially parallel to the axis.

A ball spline is a device which is capable of transmitting substantial torques whilst facilitating translational movement along the torque axis. It is envisaged that any other devices that are mechanically similar or equivalent to a ball spline may be used.

Said table-top connecting means may further comprise a sub-frame that is connected to the ball spline, and means for slidably mounting said table-top member on said sub-frame so as to allow said table-top member to slide reciprocally relative to the sub-frame in a direction substantially parallel to the axis; said slidable mounting means comprising a plurality of spaced, substantially parallel guide rails on one of said table-top member and said sub-frame, and linear bearings on the other said sub-frame and said table-top member for bearing said guide rails.

Thus, lateral movement of the table-top member relative to the mounting means may be provided by two different mechanisms which act cumulatively. Firstly, the sub-frame is able to slide laterally with respect to the mounting means on the ball spline, and secondly the table-top member itself is able to slide laterally with respect to the sub-frame on the guide rails.

Said slidable mounting means may comprise two guide rails, one guide rail being supported by two spaced bearings on said sub-frame or table-top member, and the other guide rail being supported by only one bearing, thereby to alleviate juddering when the table-top member slides relative to the sub-frame.

Said table-top connecting means may further comprise two pulleys, each of which is connected to the sub-frame for rotation about a pulley axis which is substantially orthogonal to the direction of sliding of said table-top member; and two cables, each of

which is connected at one end to a respective end of the ball spline, extends around and is reversed by a respective one of the pulleys, and is connected at its other end to a respective opposite end of the table-top member, the arrangement being such that movement of the sub-frame on the ball spline causes corresponding movement of the table-top member in the same direction relative to the sub-frame.

The pulleys and cables thus function as a "block and tackle" type mechanism with a ratio of 2:1. Thus, for each distance *d* moved by the sub-frame on the ball spline, the table-top member moves a distance *d/2* on the guide rails, providing a total lateral movement of *3/2 d.*

The two-component lateral movement of the table-top member in accordance with the present invention allows the table-top member to slide relative to the mounting means by a distance greater than the size of the opening in the side wall would allow with a one-component system.

Said ball spline may comprise a shaft and reciprocating nut adapted to travel along the shaft; said shaft being formed with a locating depression at a centre point, and said nut comprising spring loaded follower that is adapted to enter said depression when the nut is positioned at the centre point. Said follower may comprise an engaging member that is arranged normally to engage a corresponding abutment provided on said mounting means so as to prevent rotation of the table-top means from the deployed orientation to the stowed orientation, except when the nut is positioned at the centre point where entry of the follower into the depression causes the engaging member to disengage from the abutment, thereby to allow the table-top means to be returned to the stowed orientation at the centre point.

In yet another aspect of the present invention, there is provided a stowable table assembly for a vehicle, particularly an aircraft, said stowable table assembly comprising:

a mounting frame that is adapted to be fixedly secured to a supporting structure on a vehicle;

two spaced, elongate tracks that are rigidly connected to said mounting frame and are arranged to extend vertically when the mounting frame is in the fitted position, each of said tracks having a lower end and an upper end;

a table-top assembly comprising a table-top member having a table surface, and a pair of spaced track following members which define an axis therebetween, each of said track following members being disposed in and constrained to slide along a respective one

of said tracks for guiding the table-top assembly to move between a said lower stowed position proximate the lower ends of the tracks, and a second upper deployed position proximate the upper ends of the tracks, whereby said axis is oriented substantially horizontally, and said table-top assembly is capable of rotation relative to said tracks about said axis between an upright stowed orientation and a substantially horizontal deployed orientation;

a cam track that is rigidly connected to the mounting frame;

a cam follower that is rigidly mounted on said table-top assembly, which cam follower is arranged to engage the cam track, said cam track and cam follower being configured and arranged to control the rotation of the table-top assembly about the axis according to the position of the table-top assembly between said upper and lower positions, such that the table-top assembly is disposed in the stowed orientation when in the lower stowed position, and is disposed in the deployed orientation when in the deployed position;

a plurality of abutments on the mounting frame adjacent the upper end of each of said tracks; and

a corresponding plurality of load-bearing formations on the table-top assembly adjacent each track follower, each of said load-bearing formations being configured and arranged to engage a respective one of the abutments when the table-top assembly is moved to the upper deployed position and rotated to the deployed orientation, thereby to cantilever the table-top assembly from the mounting frame, such that the table-top assembly is capable of bearing loads when deployed.

In one aspect therefore the present invention provides a stowable table for a vehicle such as an aircraft in which a table-top member is moveable in a controlled fashion from a lower stowed position in which the table-top member is oriented substantially vertically in a stowed orientation, to an upper deployed position in which the table-top member is oriented in a substantially horizontal deployed orientation. In the upper deployed position, the table-top member is properly located, and is supported by cooperating engagement and abutment means on the table-top means and mounting means respectively which act to cantilever the table-top means from the mounting means.

In another aspect, the present invention provides a stowable table in which in a deployed position and orientation, the table-top member is capable of lateral reciprocating movement on a ball spline. The table-top member may be connected to the ball spline by means of a sub-frame and guide rails which are arranged to slide relative to the sub-frame

so as to provide a second component of lateral, sideways movement relative to the mounting means. The table-top member and the ball spline may be interconnected through a "block and tackle" type system, such that movement of the sub-frame along the ball spline causes corresponding movement of the table-top member relative to the sub-frame on the guide rails in a 2:1 ratio.

Following is a description by way of example only with reference to the accompanying drawings of embodiments of the present invention.

In the drawings:

FIG. 1A is a schematic drawing of a stowable tray-table in accordance with the present invention, shown *in situ* in a stowed position.

FIG. 1B is another schematic drawing of the stowable tray-table of FIG. 1A, shown in an intermediate position between the stowed position of FIG. 1A and a deployed position.

FIG. 1C is another schematic drawing of the stowable tray-table of FIGS. 1A and 1B, shown in the deployed position.

FIGS. 2A & 2B are schematic drawings of the stowable tray-table of FIGS. 1A to 1C in the deployed position, showing lateral reciprocal movement of the tray table in the deployed position.

FIG. 3 is an isometric view from above and to one side of the front of a stowable tray table in accordance with the present invention, shown in the deployed position.

FIG. 4 is a plan view of the stowable tray table of FIG. 3.

FIG. 5 is a front elevation of the tray table of FIGS. 3 and 4.

FIG. 6 is a sectional plan view of the tray table of FIGS. 3 to 5, corresponding to FIG. 4, and shown along the line VI-VI of FIG. 5.

FIG. 7 is an isometric view from above and to one side of the front of the stowable tray table of FIGS. 3 to 6, with the table-top removed to show the sub-frame and lateral reciprocating mechanism.

FIG. 8 is another isometric view of the tray table of FIGS. 3 to 7, from above and to the other side of the rear of the tray-table.

FIG. 9 is a sectional view from above of one end of a ball-spline forming part of the tray table mechanism.

FIG. 10 is a sectional view from above of another end of the ball-spline.

FIG. 11 is an isometric view from above and to the other side of the other end of the ball spline.

FIG. 12 is an isometric view from above and to the one side of the front of the one end of the ball spline.

FIG. 13 is an isometric view above and to one side of the rear of a nut forming part of the ball-spline.

FIG. 14 is a sectional side view of the tray table of FIGS. 3 to 8 along the line A-A of FIG. 5.

FIG. 15 is an enlarged view of part of FIG. 14.

FIG. 16 is a front elevation of the stowable tray table of FIGS. 3 to 8 in the deployed position, with the table-top displaced laterally from a centre position, as shown in FIG. 2A.

FIG. 17 is a sectional side view of the tray table of FIG. 16 along the line E-E.

FIG. 18 is an enlarged part of FIG. 17.

FIG. 19 is a sectional side view of the tray table of FIGS. 3 to 8 along the line C-C of FIG. 5, with the table-top in the centre position.

FIG. 20 is an enlarged view of part of FIG. 19.

FIGS. 1A to 1C show part of an upstanding side wall 12 of a seat unit for use on a vehicle, particularly a passenger aircraft. Such seat units are disclosed, for example, by WO 03/013903 A1 and WO 96/18537 A1, the contents of which are incorporated herein by reference, and need not be described in more detail herein. Said side-wall 12 may extend around all or part of a seat for use by a passenger on the vehicle and may extend vertically sufficiently high for it to serve as privacy screen.

Said side-wall typically comprises a hollow, load-bearing, aerospace grade steel sub-frame (not shown) which is clad with one or more shaped composite panels 14. The cladding 14 of the side wall 12 is cut-out to form a generally square or rectangular opening 16 which communicates with the interior of the panel 12 to form an internal recess 17. In accordance with the present invention, said recess 17 accommodates a stowable tray-table assembly 25 comprising a table-top 26 which is mounted within the recess 17 on a mounting frame as described in more detail below, and is shaped and dimensioned to fill opening 16 in the side panel 12 as shown in FIG. 1A.

Said table-top 26 comprises a hollow fabrication having opposite inner and outer edges 30 and 31 respectively, and two opposite side edges 32, 33. The table-top 26 is

mounted on the mounting frame such that it is moveable between a stowed position as shown in FIG. 1A and a deployed position as shown in FIG. 1C in which the table-top 26 projects forwardly of the side wall 12. FIG. 1B shows an intermediate position in which the table-top 26 is not fully deployed. The mounting also allows lateral reciprocal movement of the table-top 26 in a direction substantially parallel to the inner and outer edges 30, 31 as shown in FIGS. 2A and 2B, which show respectively the opposite extremities of the reciprocal movement of the table-top 26. As can be seen in FIGS. 1C and FIGS. 2A and 2B, in the deployed position, the table-top is cantilevered from the side wall 12 such that is projects forwardly from the side wall 12, and the reciprocal lateral movement as shown in FIGS. 2A and 2B allows the table to be conveniently moved sideways nearer to or further away from a passenger using the seat unit of which the side wall 12 forms part.

With reference to FIGS. 4 and 6, the table-top 26 may be moulded from a substantially rigid synthetic resin material such, for example as a thermoplastic or thermosetting resin, and has a generally rectangular or square, flat upper wall 35, a peripheral skirt 36 that extends around the two side edges 32, 33 and the outer edge 31, a plurality of internal reinforcing ribs 37, and a flat lower wall 38; the ribs 37 extend between the upper and lower walls 35, 38 within the table-top 26 in a manner well known to those skilled in the art in order to strengthen the table-top 26. The inner edge 30 is left open allowing access to the interior of the table-top 26.

The ribs 37 carry two spaced, parallel guide rails 40, 41 which extend substantially parallel to the inner and outer edges 30, 31 of the table-top 26, each of said guide rails is constituted by an hollow aluminium tube of substantially circular cross-section; the guide rails 40, 41 are fixedly secured to the table-top 26.

As shown in FIGS. 6 and 7, said tubes 40, 41 are supported slidingly by a generally triangular sub-frame 44 which extends into the interior of the table-top through the open inner edge 30, said sub-frame comprising two side members 45, 46 and a base member 47. Said base member 47 is disposed juxtaposed said inner edge 30, and the two side members extend from the base member 47 towards the outer edge 31 and converge with one another to an apex 48. Said base member 47 comprises two spaced bearings 50 for the one guide rail 40, and the other guide rail 41 extends through the apex 48 of the sub-frame 44, where it is supported by a single bearing 51. The table-top 26 is thus able to slide laterally in a direction substantially parallel to the inner and outer edges 30, 31 relative to the sub-frame

44, and the use of only one bearing 51 on the other guide rail 41 prevents juddering of the table-top 26 when it is slid.

The sub-frame 44 is connected to a ball-spline 44 adjacent the table-top 26, said ball-spline comprising a slidable nut 55 and a splined shaft 56 defining a longitudinal axis, which shaft 56 comprises a plurality of circumferentially spaced, longitudinal splines 58, the splines 58 cooperating with the nut 55 to prevent rotation of the nut about the shaft 56. As those skilled in the art will be aware a ball-spline is a device which is capable of transmitting substantial torques while allowing smooth, unhindered translational movement. Said slidable nut 55, and said shaft 56 are typically made from steel; in some embodiments said sub-frame may be made from an aluminium alloy.

Intermediate the sub-frame 44 and the slidable nut 55, the sub-frame and/or nut carries two pulleys 60. Said pulleys 60 are rotatably mounted with their axes of rotation 61 oriented substantially orthogonally to the longitudinal axis of the shaft 56 and to the plane of the upper wall 35 of said table-top 26. The axes 61 of the pulleys 60 are spaced apart in the longitudinal direction of said shaft 56. The function of the pulleys 60 is described in more detail below.

Said shaft 56 comprises a first end 65 and an opposite second end 66. Intermediate said ends 65, 66, at an approximate centre-point 67, the shaft is formed with a slight depression 68 which serves to locate the sliding nut 55 at said centre point 67 as described below.

Said nut 55 comprises a generally tubular body portion 70 which is formed towards its middle with a circumferentially extending slot 71. The body portion 70 carries a rocker assembly 72 which is pivotably mounted on a pin 73 that extends from one side of the slot 71 to the other in a direction substantially parallel to the shaft 56. Said rocker assembly 72 is biased towards the shaft 56 by two torsion springs (one shown at 74) which extend around the pin 73 and act against the rocker assembly 72. Said rocker assembly 72 comprises a base portion 75 which carries a small roller 76. Said small roller 76 is mounted on the base portion 75 by means of a short shaft 77 about which the roller 76 can rotate, and is arranged to engage and roll along the shaft 56 of the ball-spline 54. The roller 76 is positioned to enter into the depression 68 formed in the shaft 56 when the slidable nut 55 is positioned at the centre point 67. At the centre point 67, the small roller 76 enters the depression automatically under the influence of the torsion springs 74.

Adjacent the small roller 76, the base portion 75 carries a forked finger portion 78 which carries an oscillating blade element 79 between the forks 80. Said oscillating blade element 79 is mounted on a pin 81 that extends between the forks 80 and is biased outwardly of the shaft 56 by means of a torsion spring 82 which is mounted on the pin 81 and acts against the blade element 79. Said blade element 79 comprises an outwardly protruding nose portion 83 which, when the slidable nut 55 is positioned at any point along the shaft 56 other than the centre point 67, normally protrudes outwardly of the body portion 70 of the nut 55. When the nut 55 is positioned at the centre point 67, and the small roller 76 enters the depression 68, the finger portion 78, being rigidly mounted on the base portion 75 moves radially inwardly with respect to the shaft 56, and accordingly the nose portion 83 of the blade element 79 is also moved radially inwardly with respect of the shaft.

Juxtaposed the sub-frame 44, the body portion 70 of the slidable nut 55 is formed with a longitudinal open bore 85.

Proximate each the first and second ends 65, 66 of the shaft 56, the shaft 56 carries a clamp member 88, 89, which clamp member is tightly clamped or keyed to its respective end 65, 66 of the shaft 56 for rotation therewith. Each clamp member 88, 89 tightly holds one end of a respective length of cable 90 such, for example, as Bowden cable, which cable extends along the shaft 56 towards the centre point 67, into a respective end of the end open bore 85 formed in the body portion 70 of the sliding nut 55, out through an orifice (not shown) in the side of the body portion 70, and around a respective one of the pulleys 60, which reverses the direction of the cable 90 such that the cable 90 then extends back towards its respective end 65, 66 of the shaft 56 juxtaposed the inner edge 30 of the table-top 26; the other end of the cable 90 being secured to the table-top 26 juxtaposed a respective one of the side edges 32, 33.

The pulleys 60 and the cables 90 thus serve as a "block and tackle" type mechanism in which movement of the slidable nut 55 along the shaft 56 causes corresponding movement of the table-top 26 relative to the sub-frame 44 by sliding of the guide rails 40, 41 in the bearings 50, 51 provided in the sub-frame 44. The block and tackle arrangement has a ratio of 2:1, such that for distance *d* moved by the sliding nut 55 along the shaft 56, the table-top 26 moves distance *d/2* with respect to the sub-frame 44, in the same direction. Furthermore, the block and tackle arrangement of the pulleys 60 and cables 90 ensures that the respective sliding movements of the slidable nut 55 on the shaft 56 and

the table-top 56 on the sub-frame 44 are coincident at their extremities. Thus, when the slidable nut 55 is disposed at the extremity of its travel proximate one end 65, 66 of the shaft 56, the table-top 26 is also positioned at the extremity of its movement on the sub-frame in the same direction; and when the slidable nut 55 is disposed at the other extremity of its movement juxtaposed the other end 66, 65 of the shaft 56, the table-top 26 is disposed at the opposite extremity of its respective travel on the sub-frame 44. Movement of the nut 55 along the shaft 56 thus causes reciprocal lateral movement of the table-top 26 relative to the shaft 56 as shown in FIGS. 2A and 2B.

Proximate the first end 65 of the shaft 56, outwardly of the respective clamp member 88, the shaft 65 carries a roller 100. Said roller 100 is arranged to engage an elongate, substantially linear track 101 which comprises two opposing faces 102 (see FIG. 10) which engage the roller 100 with a small tolerance.

Proximate the second end 66 of the shaft 56, the shaft 56 carries a second roller 103 outwardly of the respective clamp 89, which second roller 103 is received in a second elongate substantially linear track 104, which second track 104 is disposed substantially parallel to the first track 101, and comprises two opposing faces 105 which engage the second roller 103 with a small tolerance.

The rollers 100, 103 are constrained to move within their respective tracks 101, 104, and permit rotation of the shaft 56 about its own longitudinal axis.

Said first and second tracks 101, 104 are attached to a mounting frame 108 which is adapted for fixedly mounting the table assembly 25 within the recess 17 in the side wall 12, such that the first and second tracks 101, 104 are oriented substantially vertically, and the ball spline 54 extends substantially horizontally therebetween. Said mounting frame 108 comprises two opposing, upright side parts 109, 110 which house the first and second tracks 101, 104 respectively, an upper bridging part 111 which interconnects the side parts 109, 110 at their upper ends, and a lower plate-like part which also interconnects the two side parts 109, 110. In the fitted position, the tracks 101, 104 extend substantially vertically between upper and lower ends 106, 107 respectively.

As best seen in FIGS. 18 and 20, the upper bridging part 111 comprises a channel section with a depending rear wall 113 which is formed with an elongate groove 114 serving as a catch for the nose portion 83 of the blade element 79 on the rocker assembly 72 of the slidable nut 55. Said upper bridging part 111 is configured and positioned such that, other than when the sliding nut 55 is disposed at the centre point 67, the nose portion

83 of the rocker assembly 72 engages in the groove 114 to prevent rotation of the shaft 56 about its longitudinal axis.

At each end 65, 66, the shaft 56 comprises a coaxially-mounted, freely-rotatable pinion 116 which is arranged to engage a respective, corresponding linear rack 117 which is rigidly mounted on the mounting frame 108, said rack 117 being arranged substantially parallel to and juxtaposed the respective first or second track 101, 104, and extending fully between the upper and lower ends 106, 107.

Proximate the first end 65 of the shaft 56, the shaft carries a cam follower assembly 20 as best seen in FIG. 11. Said cam follower assembly 120 comprises a L-shaped block 121 which is keyed onto the end 65 of the shaft 56 of rotation therewith. Said block 121 protrudes on both sides of the shaft in generally opposite directions, having a relatively small, forwardly protruding "beak" portion 135, and relatively large, rearwardly protruding body portion having a substantially flat upper surface 122, and carrying a cam follower wheel 123 which is mounted for rotation on a shaft 124 defining an axis of rotation that is substantially parallel to the shaft 56, but radially offset therefrom.

Said cam follower wheel 123 engages a shaped cam track 128 which comprises two opposing faces 129 (one face shown in dashed lines in FIGS. 14 and 15) that extends juxtaposed the first track 101 at the first end 65 of the shaft 56. Said opposing faces 129 engage the cam follower wheel 123 with a small tolerance. As best seen in FIG. 14, towards the lower end 107 of the first track 101, the cam track 128 extends substantially parallel to the first track 101. However, an upper section 130 of the cam track 128 is inclined rearwardly with respect to the first track 101 for the reasons described in more detail below. At the lower end 107 of the first track, the cam track 128 is also inclined relative to the first track over a short distance.

Juxtaposed the first end 65 of the shaft 56, intermediate the first track 101 and the adjacent rack 117, at the upper end 106 of the track 101, the side part 109 of the mounting frame 108 carries an abutment plate 132 having a shaped, inwardly directed engaging surface 133. Said abutment plate 132 is aligned with the forwardly protruding "beak" portion 135 of the L-shaped block 121. Said beak portion 135 is arranged to engage the engaging surface 133 of the abutment plate 132 when the shaft 56 is disposed at the upper end 106 of the tracks 101, 104, and when the shaft 56 is rotated about its axis such that the table-top 26 extends forwardly, substantially horizontally from the shaft 56.

Rearwardly of the shaft 56, the side part 109 of the mounting frame 108 is formed with a shelving abutment surface 134 which is arranged to engage the upper surface 122 of the body portion of the L-shaped block 121, when the beak portion 135 engages the engaging surface 133 of the abutment plate 132 as described above.

The L-shape block 121 thus engages the mounting frame 108 at two spaced locations on opposite sides of the shaft 56 when the table-top is horizontal.

At the second end 66 of the shaft 56, the clamp member 89 protrudes to each side of the shaft 56 in generally opposite directions as shown in FIG. 9 to provide a rear section 91 having a substantially flat upper surface 92, and a forwardly protruding "beak" portion 93. Inwardly of the second track 104, the side part 110 of the mounting frame 108 comprises an abutment plate 137 which is arranged to engage the beak portion 93 of the clamp member 89 when the table-top is horizontal, and the side part 110 is formed with a shelving abutment surface (not shown), similar to abutment surface 134, which is arranged to engage the upper surface 92 of the rearwardly protruding section 91. Thus when the table-top 26 is oriented substantially horizontally as described above, the second end 66 the shaft 56 also engages the mounting frame 108 at two spaced locations to either side of the shaft 56.

With reference to FIGS. 11 and 12, the first end 65 of the shaft 56 further carries a cradle assembly 140 comprising two axially spaced side plates 141, 142, and an upper bridging piece 143. The first end 65 of the shaft 56 extends through the two side plates 141, 142, such that the shaft 56 can freely rotate relative to the side plates 141, 142, and the bridging piece 143 carries a rotary damper mechanism 145 which is linked to the shaft 56 for damping rotation thereof through a plurality of links 146. The use of rotary damping systems is well known in the art, and is not described in further detail herein.

Said cradle assembly 140 further provides an anchorage point 148 for an end of a constant force spring device 150 which is fixedly mounted on a plate 151 secured to the mounting frame 108.

The mounting frame 108 also supports a solenoid latching device 153 for latching the table-top 26 in the stowed position as shown in FIG. 1A and described in more detail below. Solenoid latching devices 153 are well known in the art, and accordingly further details of the solenoid latching device 153 are not provided herein.

As best shown in FIG. 3, the lower part 112 of the mounting frame 108 is formed with an arcuate slot 159 which receives a short stud (not shown) protruding from a small

cylindrical pusher member 160 which is thus constrained to slide along the slot 159. Said pusher member 160 may be formed from natural or synthetic rubber, or from any other non-hard material. A torsion spring 161 mounted on a pin 162 urges the pusher member 160 upwards within the slot 159.

Said tracks 101, 104 thus serve to guide translational movement of the shaft 56 of said ball spline 54 in a generally vertical direction between a lower position juxtaposed the lower ends 107 of the tracks 101, 104 and an upper position juxtaposed the upper ends 106 of the tracks 101, 104. The rollers 100, 103 at the first and second ends 65, 66 of the shaft 56 respectively are constrained to move in the tracks 101, 104, and thus serve to locate the shaft 56 stably. As the rollers 100, 103 move up and down the respective tracks 101, 104, the pinions 116 at the opposite ends of the shaft 56 engage their respective racks 117 to ensure that the two ends 65, 66 of the shaft 56 move together, and thereby avoid "crabbing". As a result, the shaft 56 moves smoothly between the upper and lower and positions.

The cam mechanism comprising the cam follower assembly 120 and cam track 128 serves to control rotation of the shaft 56 about its longitudinal axis. With reference to FIG. 14, when the shaft 56 is disposed in the lower position, the cam follower wheel 123 is constrained by the cam track 128 to be disposed generally beneath the shaft 56, such that the sub-frame 44 mounted to the ball spline 54, and thus the table-top 26, are disposed in a substantially upright orientation as shown in FIG. 1A. As the shaft 56 moves upwardly from the lower position towards the upper position, the configuration of the cam track 128 causes the cam follower wheel 123 to rotate about the shaft 56, and because the L-shaped block 121 is fixedly keyed onto the shaft 56, rotation of the block 121 causes corresponding rotation of the shaft 56 itself, resulting in rotation of the table-top 26 from the upright position, through an intermediate position as shown in FIG. 1B to a deployed position as shown in FIG. 1C, in which the table-top 26 projects forwardly of the shaft 56, with the upper and lower walls 35, 38 being disposed substantially horizontally.

In the upper position as shown in FIGS. 14 and 15, the table-top 26 is disposed substantially horizontally as mentioned above, and the beak portion 135 and upper surface 122 of the L-shape block 121 project respectively forwardly and rearwardly of the shaft 56 in generally opposite directions to engage respectively the engaging surface 133 of the abutment plate 132, and the shelving abutment surface 134 defined by the side part 109 of the mounting frame 108 juxtaposed the upper end 106 of the track 101. At the second end

66 of the shaft 56, the upper surface 92 of the rear section 91 of the clamp member 89, and the beak portion 93 of the clamp member 89 engage respectively on the shelving abutment surface defined by the side part 110 of the mounting frame 108 and the abutment plate 137.

Thus at each end 65, 66 of the shaft 56, the mounting frame 108 reacts against the L-shaped block 121 and cam member 89 respectively at two spaced locations on either side of the shaft 56, thereby to cantilever the table-top 26 from the shaft 56. The engagement of the rollers 100, 103 in the respective tracks 101, 104 serves to locate the shaft 56 stably in the upper position at the upper ends 106 of the tracks 101, 104, such that the beak portions 93, 135, and the upper surfaces 92, 122 stably engage the abutment plates 132, 137 and engaging surfaces 134 respectively, whereby the table-top 26 is capable of bearing substantial loads.

The weight of the table-top 26 and ball spline 54 is counter-balanced by the constant force spring device 150 to prevent the table-top 26 from dropping towards the lower position under its own weight.

In the upper position, with the table-top 26 deployed substantially horizontally, the table-top 26 is capable of lateral or reciprocating movement as described above by movement of the slidable nut 55 on the shaft 56, in spite of the torque transmitted through the ball spline 54.

When the table-top 26 is positioned laterally away from the centre point 67, the small roller 76 carried by the rocker assembly 72 on the nut 55 rides along the surface of the shaft 56, such that the nose portion 83 of the blade element 79 is urged outwardly by said torsion spring 82 into engagement with the elongate groove 114 formed in the upper bridging part 111 of the mounting frame 108, as shown in FIG. 18. Such engagement of the blade element 79 in the groove 114 serves to prevent rotation of the shaft 56 about its axis, and thus serves to prevent the table-top 26 from being returned to its lower stowed position.

However when the slidable nut 55 is positioned at the centre point 67 as shown in FIGS. 19 and 20, the small roller 76 enters into the depression 68 formed in the shaft 56, thus disengaging the blade element 79 from the groove 114 formed in said upper bridging part 111 of the mounting frame 108. With the blade element 79 released, the shaft 56 is able to rotate about its axis, disengaging the beak portions 93, 135 and upper surfaces 92, 122 from the respective abutment plates 132, 137 and engaging surfaces 134, such that the shaft 56 may be moved downwardly in the tracks 101, 104 to restore it to the lower

position. As the shaft 56 is moved downwardly, the interaction of the cam track 128 and cam follower assembly 120 controls rotation of the shaft 56 in the manner described above, but in reverse, to cause the table-top 26 to rotate from its substantially horizontal deployed position to its upright position as shown in FIG. 1A, in which the table-top 26 occupies the opening 16 formed in the side wall 12, and the bottom wall 38 of the table-top 26 is disposed flush with the surface of the surrounding panel 14.

In the lower stowed position, the inner edge 30 of the table-top 26 engages the pusher member 160, urging it to move downwardly in said arcuate slot 159 against the force of the torsion spring 161. The solenoid latching device 153 operates automatically to latch the table-top 26 in the lower position.

When it is desired to re-deploy the table-top 26, the solenoid latching device 153 is operated to release the table-top, and the restoring force of the torsion spring 161 acting on the pusher member 160 urges the pusher member 160 to move upwardly in the slot 159, pushing the table-top 26 upwards by a short distance along the tracks 101, 104. As mentioned above, the cam track 128 is toed-in at the lower ends 107 of the tracks 101, 104, such that the initial movement of the table-top 26 produced by the pusher member 160 causes the shaft 56 to rotate slightly to angle the table-top 26 forwardly away from the side-wall 12. This enables a passenger to grab hold of the outer edge 31 of the table-top 26 in order to pull the table-top 26 manually upwards, thereby to deploy the table-top fully.

The stowable table assembly 25 in accordance with the present invention is thus able to provide a substantially-sized, stably mounted table-top 26 which can be stowed in a substantially upright orientation as shown in FIG. 1A and deployed to a substantially horizontal orientation as shown in FIG. 1C. The engagement of the rollers 100, 103 in the tracks 101, 104, and the interengagement of the pinions 116 with their respective racks 17 provides a smooth, stable movement of the table-top 26 from the lower position to the upper position. The interengagement of the cam track 128 and the cam follower assembly 120 controls rotation of the shaft 56 about its axis as the table-top 26 moves from the lower position to the upper position, such that in the lower position the table-top 26 is constrained in the upright stowed orientation, and in the upper position it is caused to be deployed in the substantially horizontal orientation. The rollers 100, 103 serve to locate the shaft 56 accurately at the upper ends 106 of the tracks 100, 104, enabling stable, load-bearing engagement of the beak portions 93, 135 and engaging surfaces 92, 122 with the respective abutment plates 132, 137 and abutment surfaces 134 in order to cantilever the table-top 26

from the mounting frame 108. In spite of the torque transmitted through the shaft 56, the ball spline 54 allows the table-top 26 to reciprocate easily in a lateral direction as shown in FIGS. 2A and 2B when in the deployed position and orientation, so as to enable the table-top 26 to be moved to any convenient position as desired by a passenger.

In the stowed position, the table assembly 25 advantageously occupies a very small footprint area, enabling it to be fitted in relatively narrow side walls 12 of the kind forming parts of housings for aircraft seat units.